

# Pros For Hemodialysis



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# Objectives

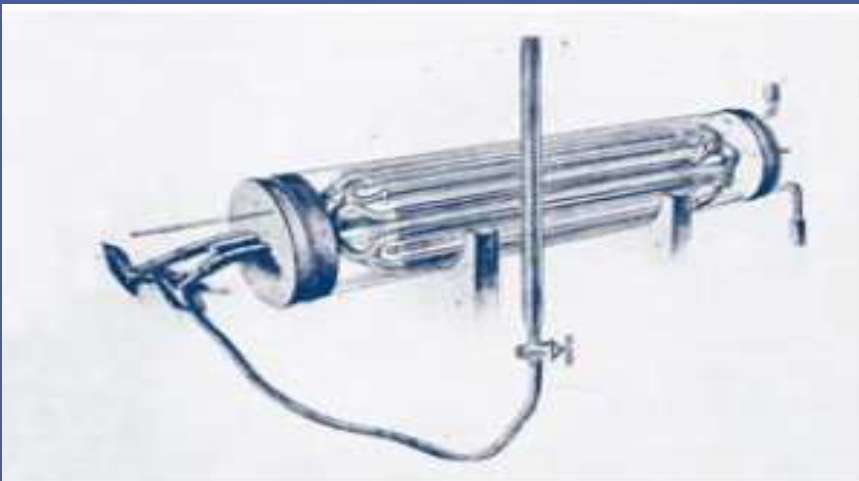
- History.
- Dialysis Principles.
- Selection Of Dialysis Modalities.
- HD Modalities.
- Potential Advantages Of HD.
- Complications Of PD.
- Conclusions.

# History



## John Abel: 1913

- From Johns Hopkins.
- Develops primitive dialysis system.
- Testing on **animals** with no success.



# History

## George Haas: 1926

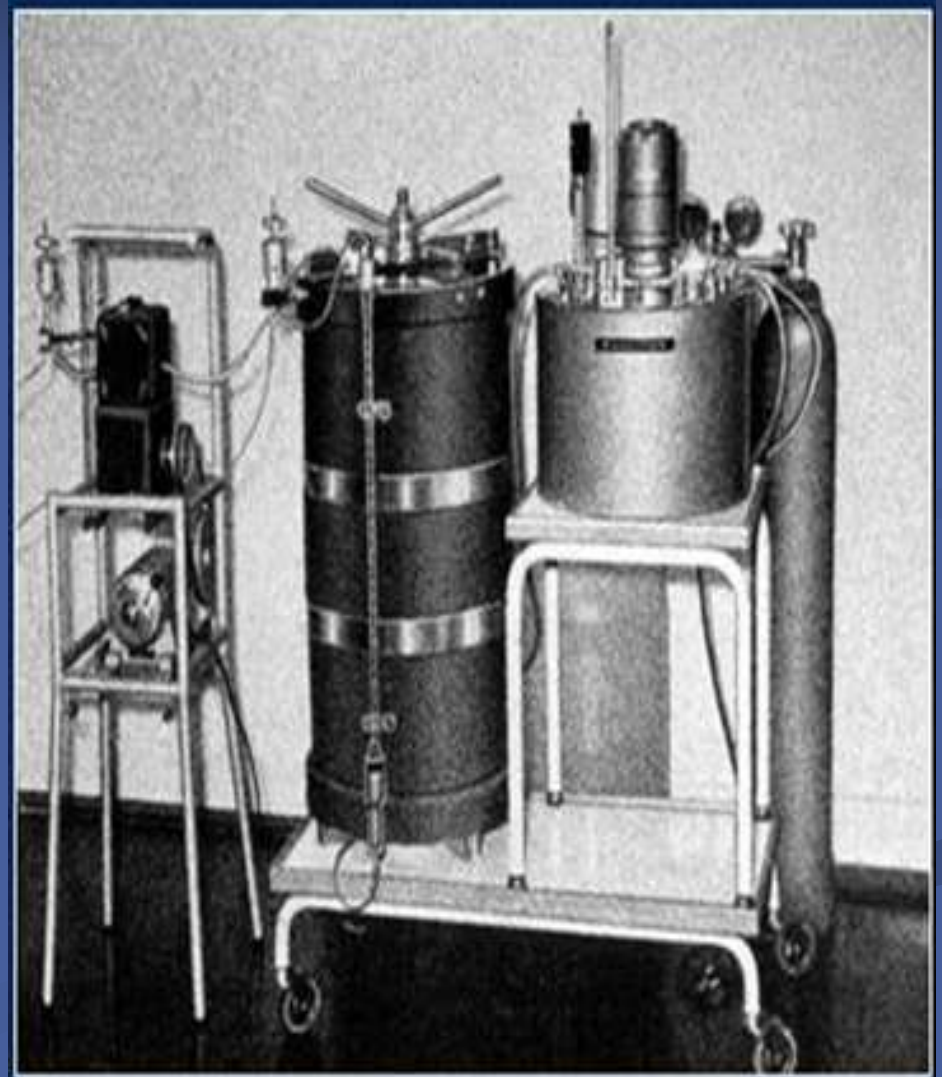
- From Giessen, Germany.
- He used a tubular device made of collodion, cannulation of the radial and carotid arteries and the portal vein and hirudin for anticoagulation.
- Patient died as no enough clearance.



# History

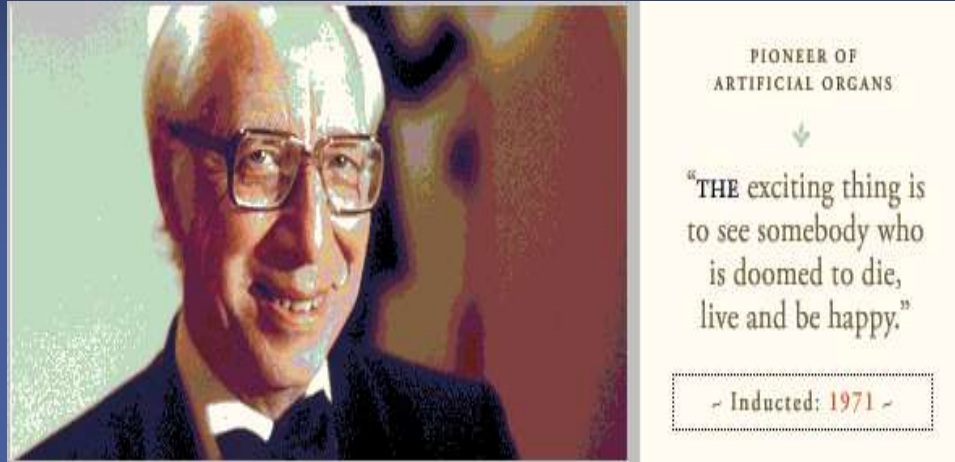


- 1937: Nils Alwall used the **Alwall Kidney** to perform the first ever hemodialysis treatment at the university of Lund, Sweden.





# History



## Willem Kolff: 1933-1945

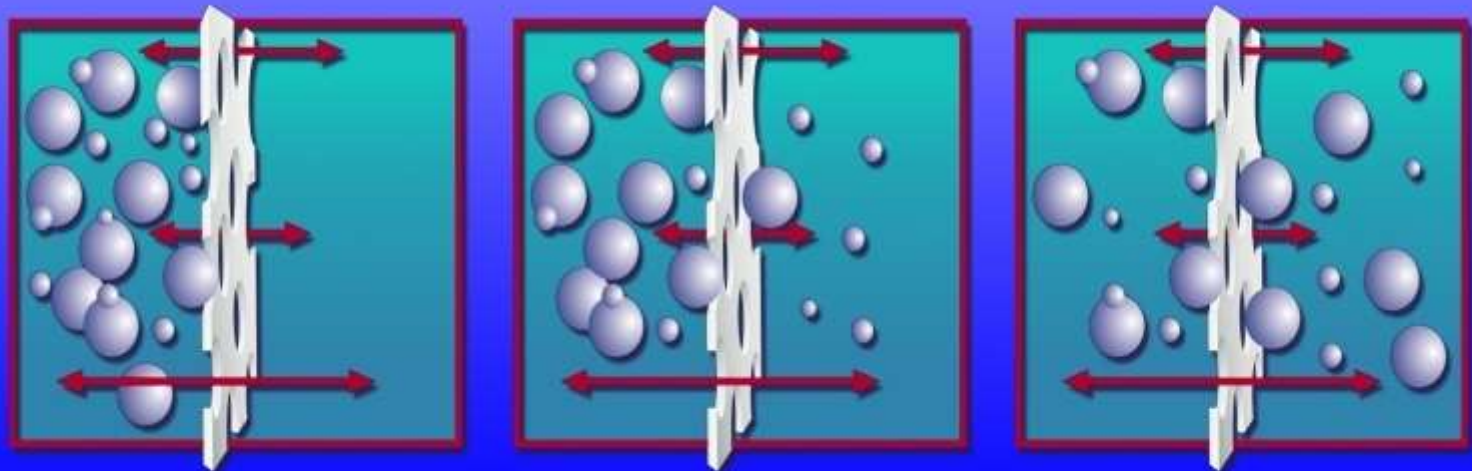
- From Netherland.
- Invented the “drum dialyzer”.
- Treated a patient with ARF in 1945.
- Distributed 6 machines to western world.

# Dialysis Principles

- Artificial process that **partially** replaces renal function.
- Removes waste products from blood by diffusion (toxin clearance).
- Removes excess water by ultrafiltration (maintenance of fluid balance).
- **Haemodialysis** & **Peritoneal** Dialysis work on similar principles: Movement of solute/water across a semipermeable membrane.

# Diffusion

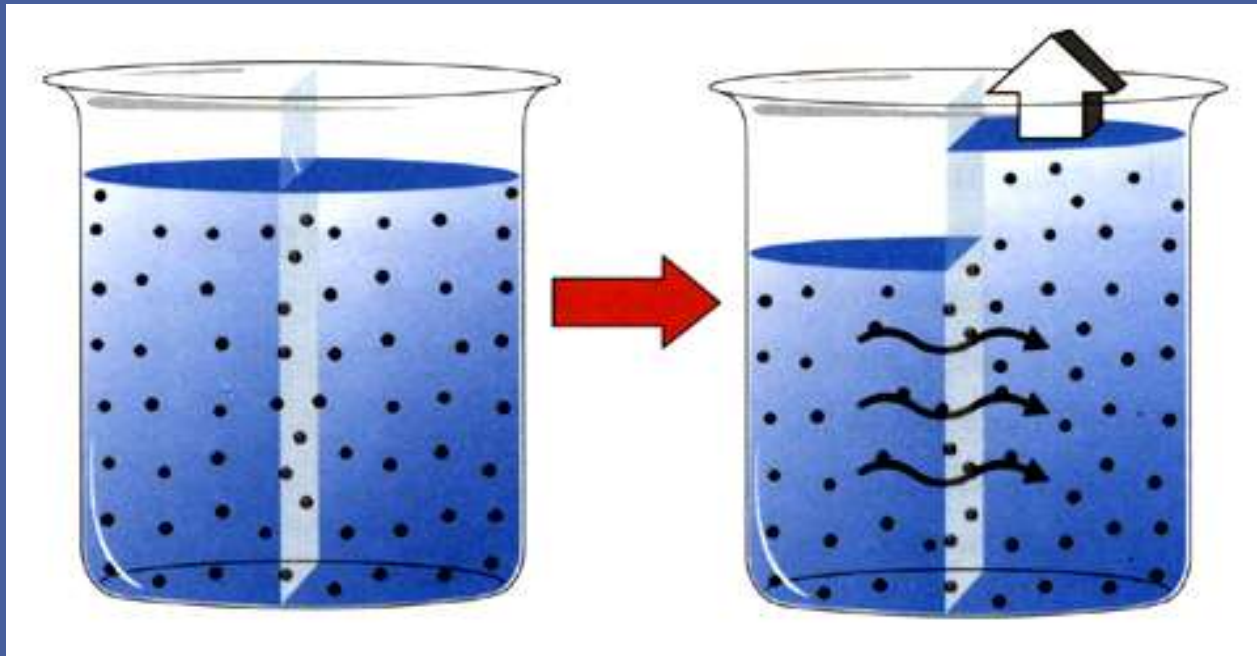
- It is a transport process by which solutes move passively down its **concentration gradient** from an area of greater concentration to an area of lesser concentration (HD).



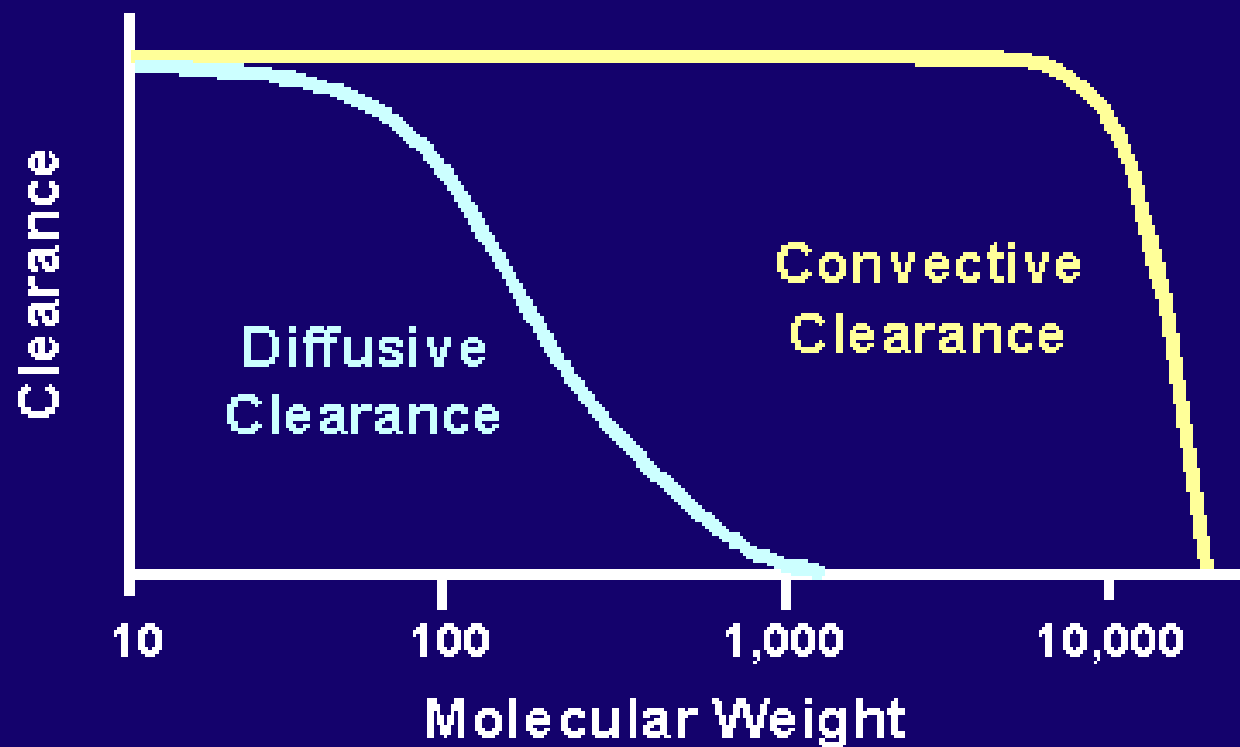


# Convection

- It occurs as a result of **hydrostatic pressure gradient** across the membrane. Solutes that are dissolved in the water are transported passively with the water movement - solvent drag (HF).

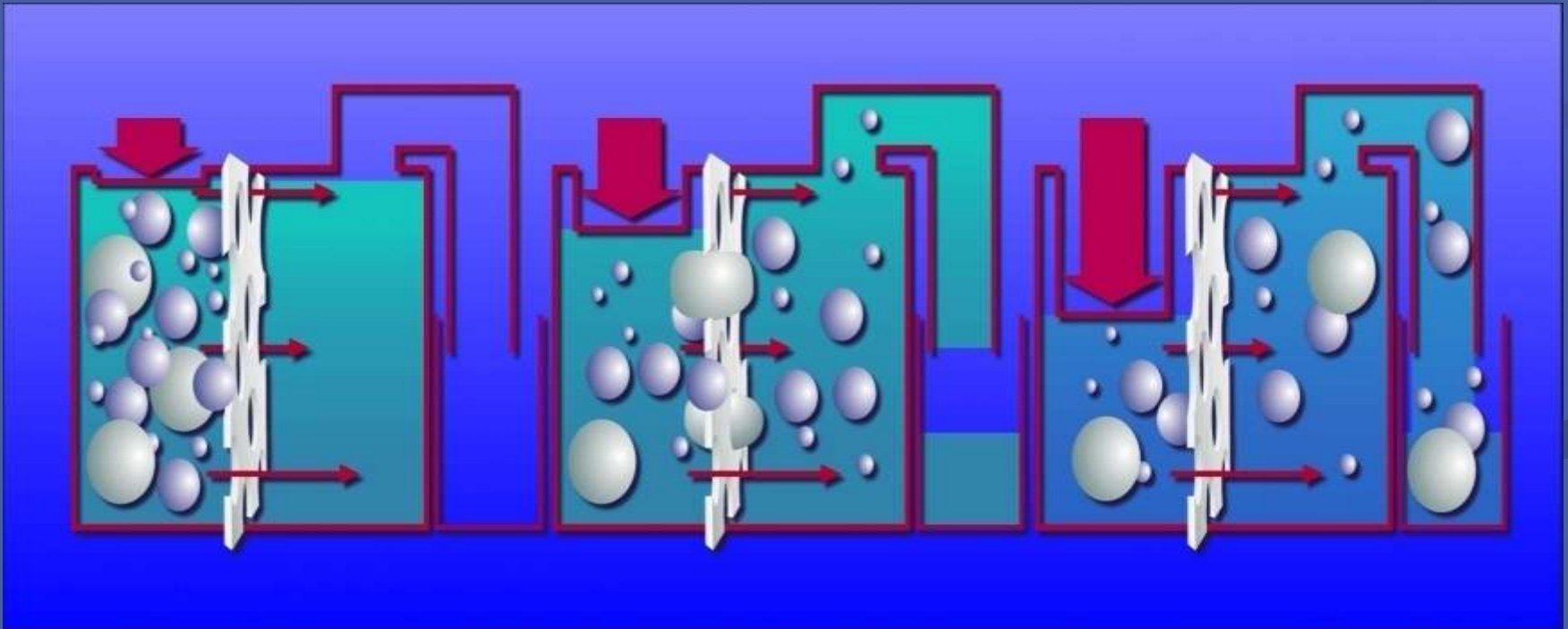


# Convection vs. Diffusion



# Ultrafiltration

- Controlled fluid removal by manipulation of hydrostatic pressure gradient across the membrane which is generated by the dialysis machine.

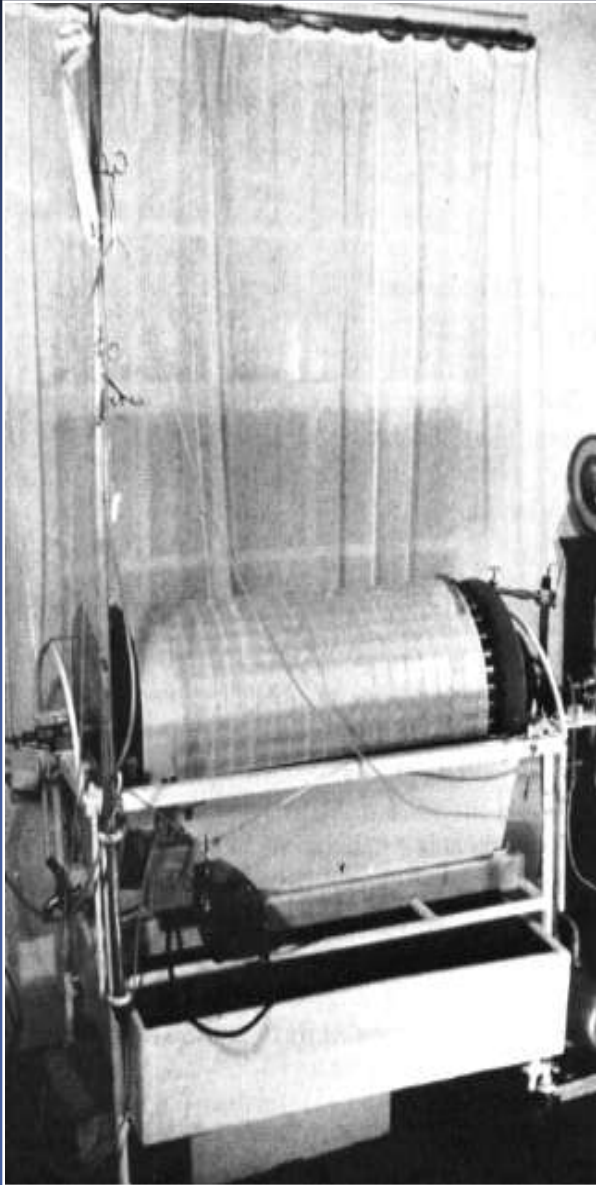


# THE TECHNOLOGICAL PROGRESS IN HEMODIALYSIS





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Automated, wearable, artificial kidney, FDA approves Victor Gura MD(2014)



# Selection for HD/PD

- It must be individualized to patient's age, preference, education, geographic location, family and social support.
- Clinical status and extent of comorbid conditions.
- Affordability/Availability.
- Patient lifestyle.
- Patient competence/hygiene.

# HD Modalities

## ✓ Center HD :

- In-center HD (Intermittent – Daily).
- Nocturnal in-center HD.
- At a Minimal Care / Self-Care Centre.

## ✓ Home HD

- Intermittent home HD.
- Daily home HD.
- Nocturnal home HD.

## ✓ Modes of HD therapy:

- Low-flux HD.
- High-flux HD.
- HDF.

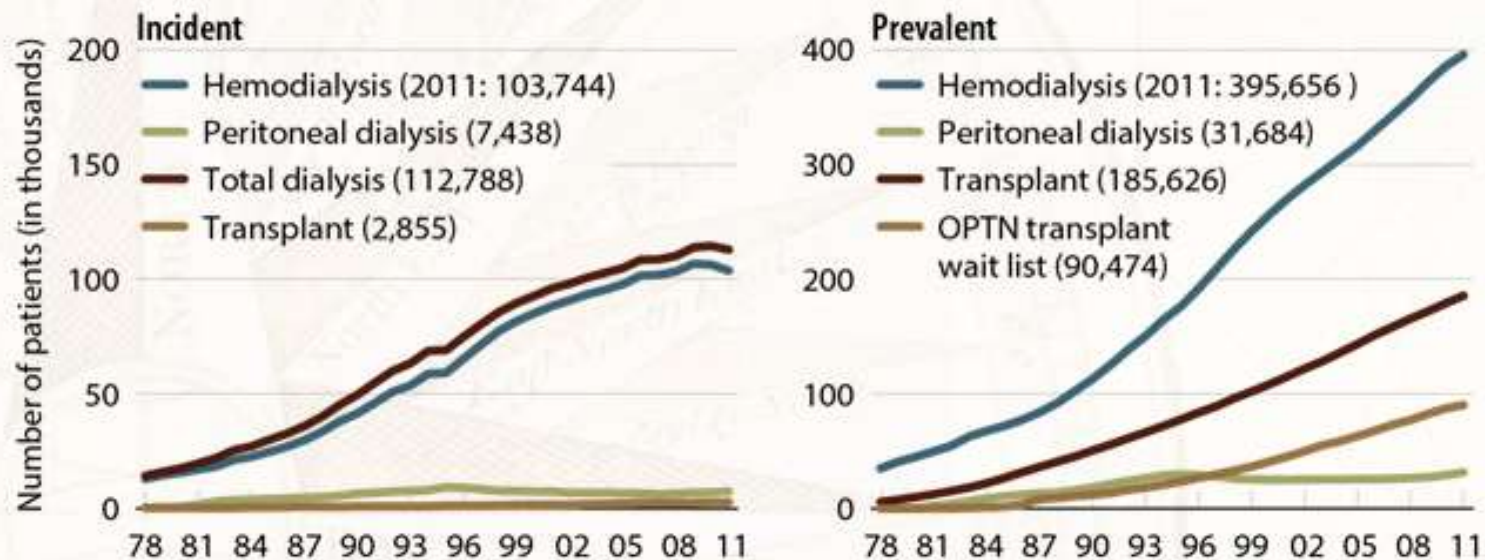


# Potential Advantages Of HD

- Very efficient therapeutic modality.
- Frequent follow up in the center (3-6 weekly).
- No protein loss to dialysate.
- Very suitable for most patients with hypercatabolic states and drug toxicity.
- Very helpful for emergency situations e.g hyperkalemia.
- No time consuming.
- It allows you to be in contact with other people having dialysis, which may give you emotional support.

# Incident & prevalent patient counts (USRDS), by modality

Figure 1.1 (Volume 2)

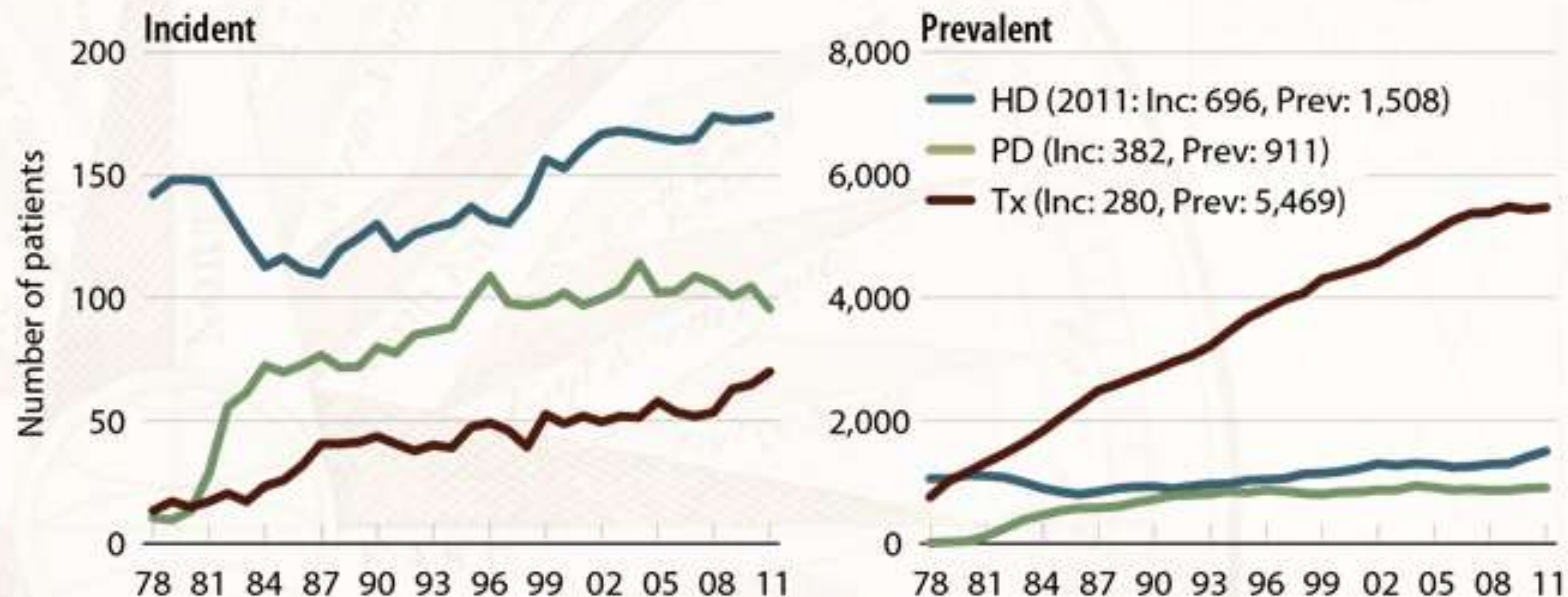


Incident & December 31 point prevalent ESRD patients; peritoneal dialysis consists of CAPD & CCPD.

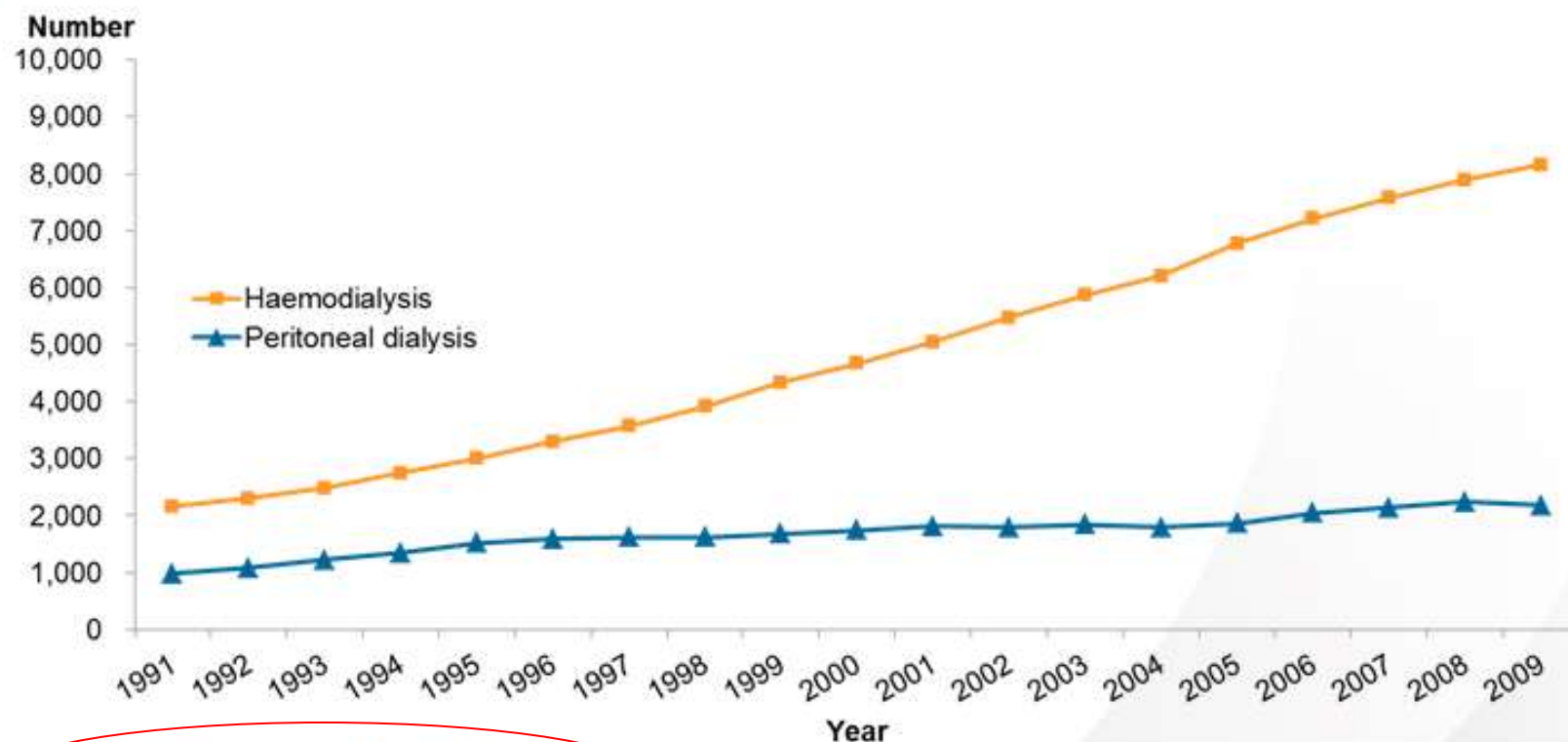


# Incident & prevalent counts for pediatric ESRD patients

Figure 8.1 (Volume 2)



Incident & prevalent ESRD patients age 0–19, 2011.

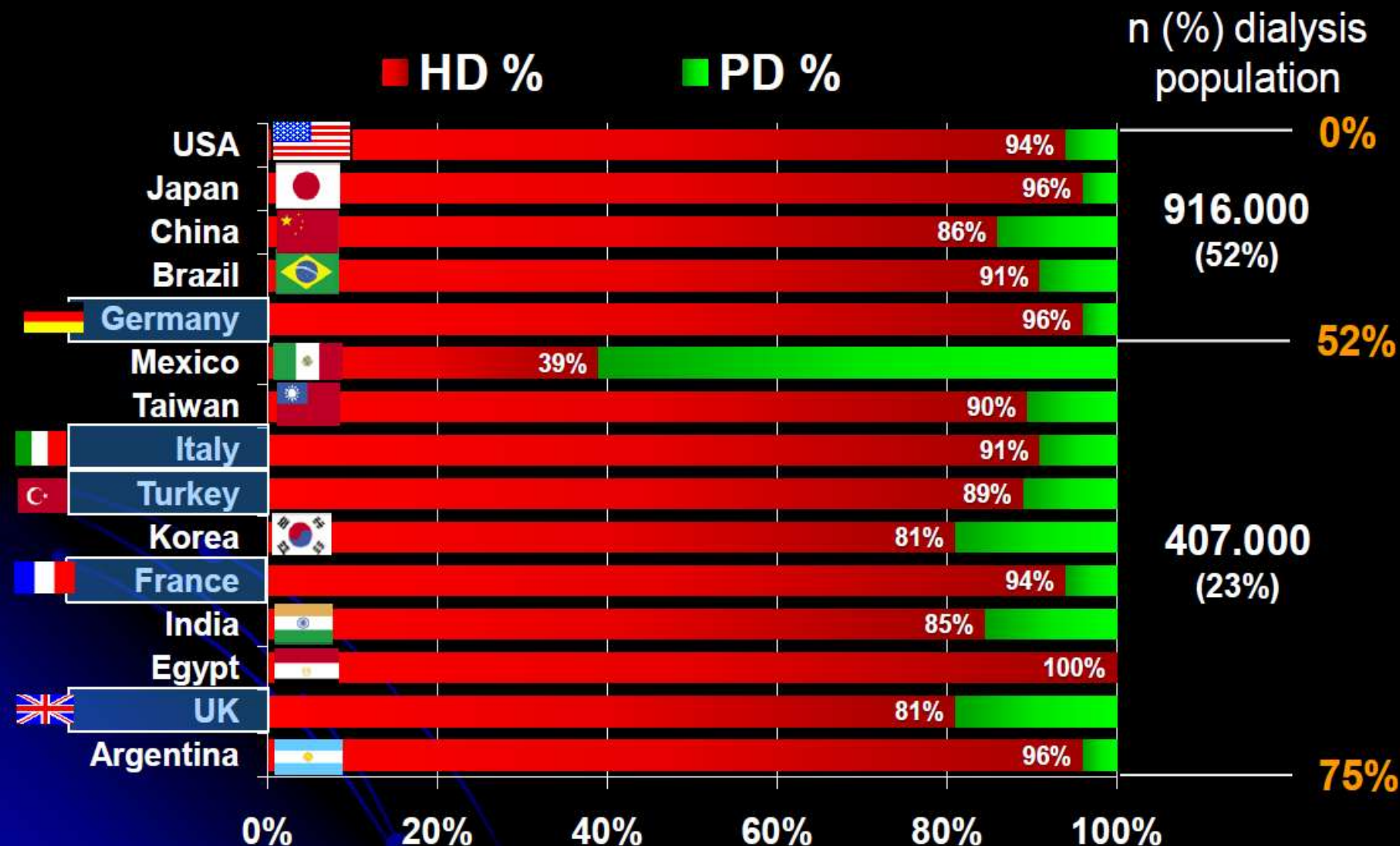


Source: AIHW analysis of ANZDATA Registry data.

Reference: AIHW 2012. Dialysis and kidney transplantation in Australia 1991–2010. Cat. no. PHE 162. Canberra: AIHW.

**Figure 5.1: Trends in the number of haemodialysis and peritoneal dialysis patients, 1991 to 2009**

# The 15 largest dialysis countries - HD vs PD



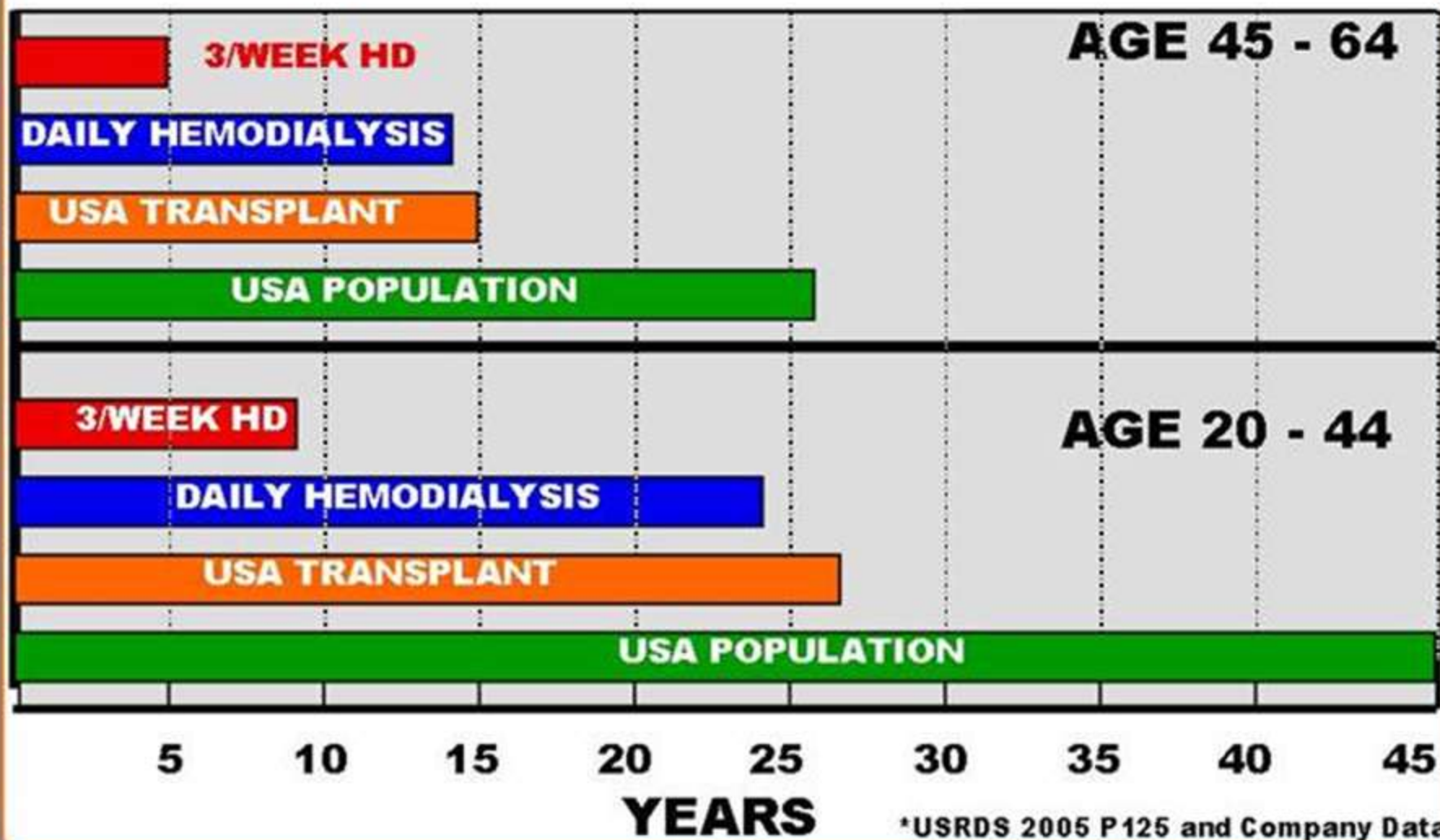
European countries

Data Fresenius Medical Care 2009

© wm @ SFAV, Tours, June 2010



# Daily Hemodialysis Life Expectancy



# Complications of PD

- Peritonitis (subsequent membrane/ ultrafiltration failure) - EPS.
- Malnutrition.
- Hernias.
- Fluid leaks.
- Hypertension.
- Increased cardiovascular risk.
- Renal bone disease (ABD).
- Anaemia.
- Psychosocial/sexual factors.



## Peritoneal Dialysis Patients Have Higher Prevalence of Gastrointestinal Symptoms Than Hemodialysis Patients

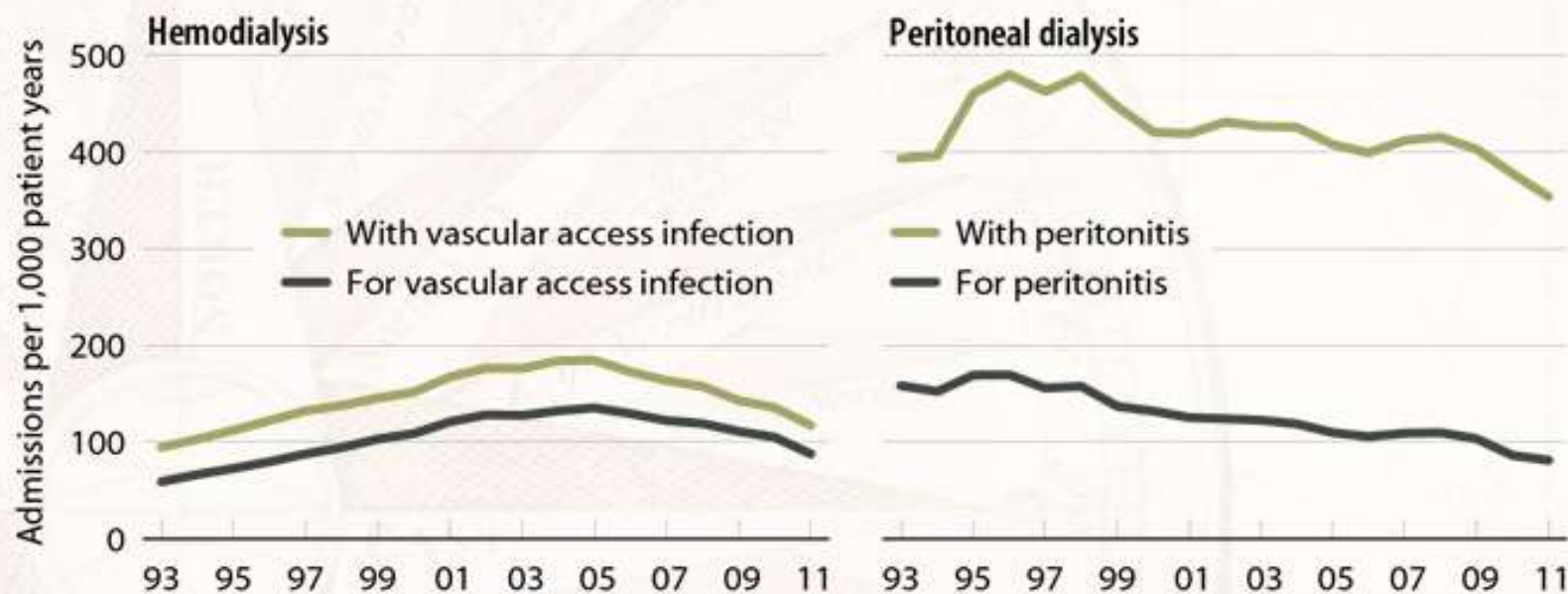
**Table 3.** Influence of Gastrointestinal Symptoms on Dietary Intake

Influence of Symptoms on Intake	HD (n = 172)	PD (n = 122)	P Value
Gastrointestinal symptoms decreased food intake	24 (13.9)	65 (53.3)	<.001
Changed diet in attempt to control symptoms	16 (9.4)	41 (33.6)	<.001
Use of oral nutritional supplements	38 (22.2)	16 (13.1)	.04
Symptoms began/worsened with dialysis	20 (11.6)	67 (54.9)	<.001
Medication to control symptoms	56 (32.5)	52 (42.6)	.08

Data are expressed as number (percentage).

# Adjusted rates of hospital admissions, by modality & diagnosis code type: dialysis-related infection

Figure 3.6 (Volume 2)



Period prevalent dialysis patients. Adj: age/gender/race/primary diagnosis; ref: ESRD patients, 2010.

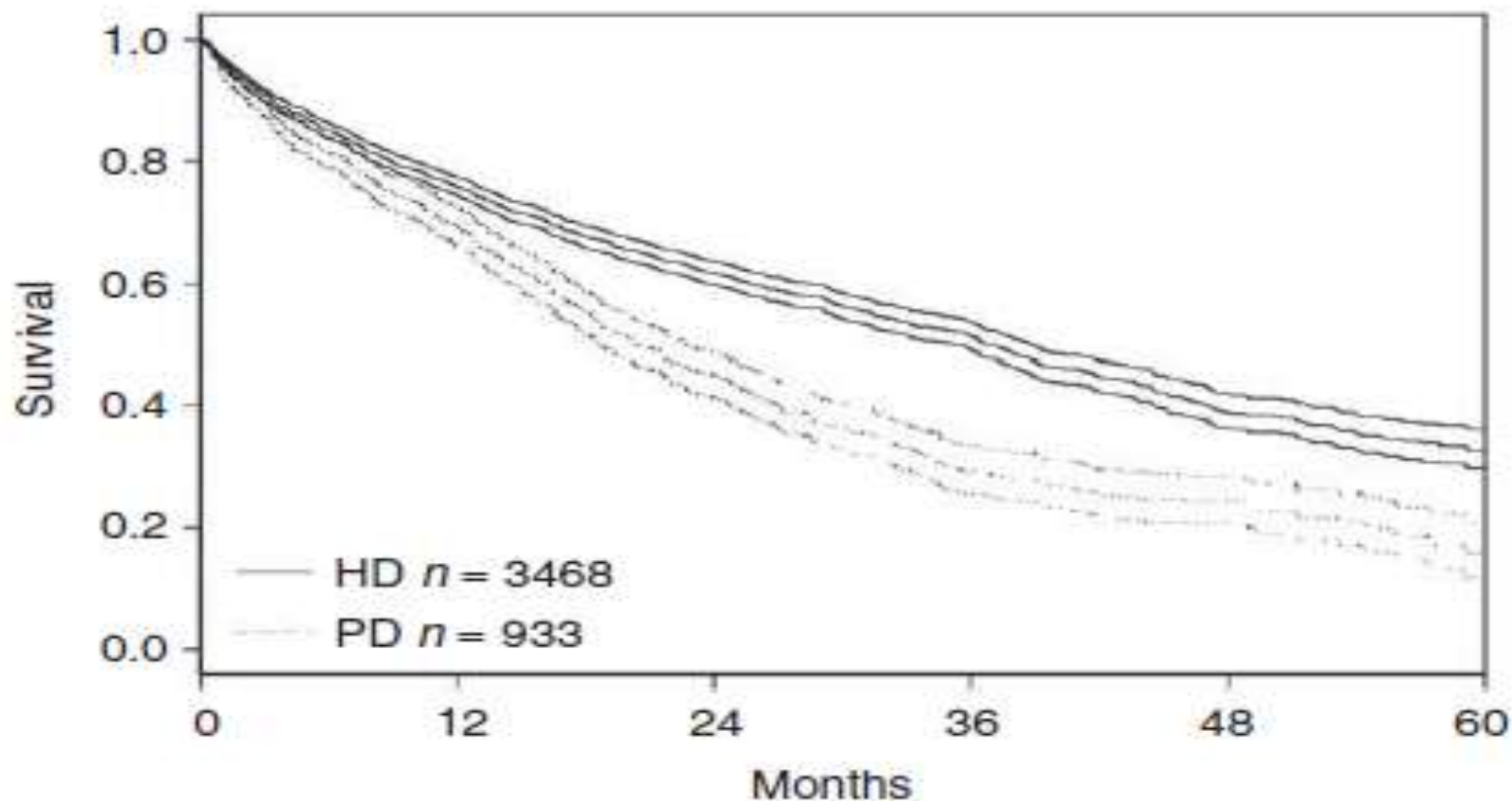
## Hemodialysis and peritoneal dialysis: comparison of adjusted mortality rates according to the duration of dialysis: analysis of The Netherlands Cooperative Study on the Adequacy of Dialysis 2.

Termorshuizen F<sup>1</sup>, Korevaar JC, Dekker FW, Van Manen JG, Boeschoten EW, Krediet RT; Netherlands Cooperative Study on the Adequacy of Dialysis Study Group.

### + Author information

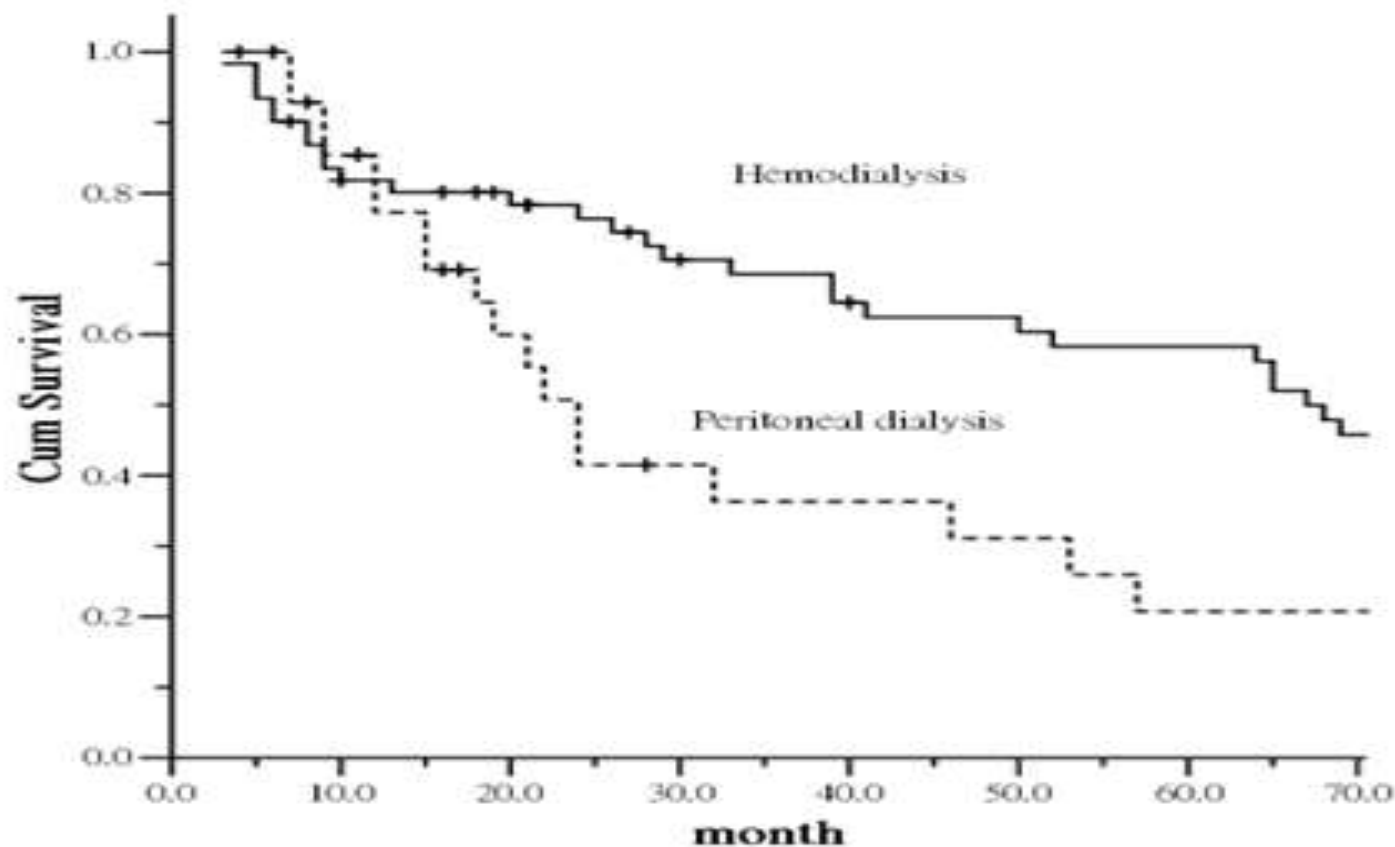
#### Abstract

Various studies indicate that fair comparisons of mortality rates between hemodialysis (HD) patients and peritoneal dialysis (PD) patients are difficult because of differences in patient characteristics, because of nonconstant relative risks of death (RR), and because the survival times of patients who switch treatment modalities can be censored in different ways. The differences in mortality rates between HD and PD patients were investigated in an analysis in which these potential sources of bias were taken into account. The Netherlands Cooperative Study on the Adequacy of Dialysis is a multicenter, prospective, observational, cohort study in which new patients with ESRD are monitored until transplantation or death. A multivariate Cox regression analysis was used to analyze the mortality data according to treatment modality (HD, n = 742; PD, n = 480). No statistically significant differences in adjusted mortality rates between HD and PD patients were observed during the first 2 yr of dialysis. In the years thereafter, increases in mortality rates for PD patients and resulting decreases in RR in favor of HD were observed (e.g., months 24 to 36, adjusted RR, 0.53; 95% confidence interval, 0.31 to 0.91). This tendency was observed especially among patients  $\geq 60$  yr of age and was not influenced by the censoring strategy. These results suggest that long-term use of PD, especially among elderly patients, is associated with increases in mortality rates. Further analyses are required to determine the potential role of dialysis adequacy in the observed long-term differences in mortality rates between HD and PD patients and to establish the possible survival benefits for PD patients who switch to HD in time.



**Figure 1 | Non-adjusted survival and 95% confidence interval by day 90 dialysis modality in incident end-stage renal disease patients with associated congestive heart failure (French REIN Registry, 2002–2008, Kaplan–Meier,  $P < 0.0001$ ). HD, hemodialysis; PD, peritoneal dialysis.**

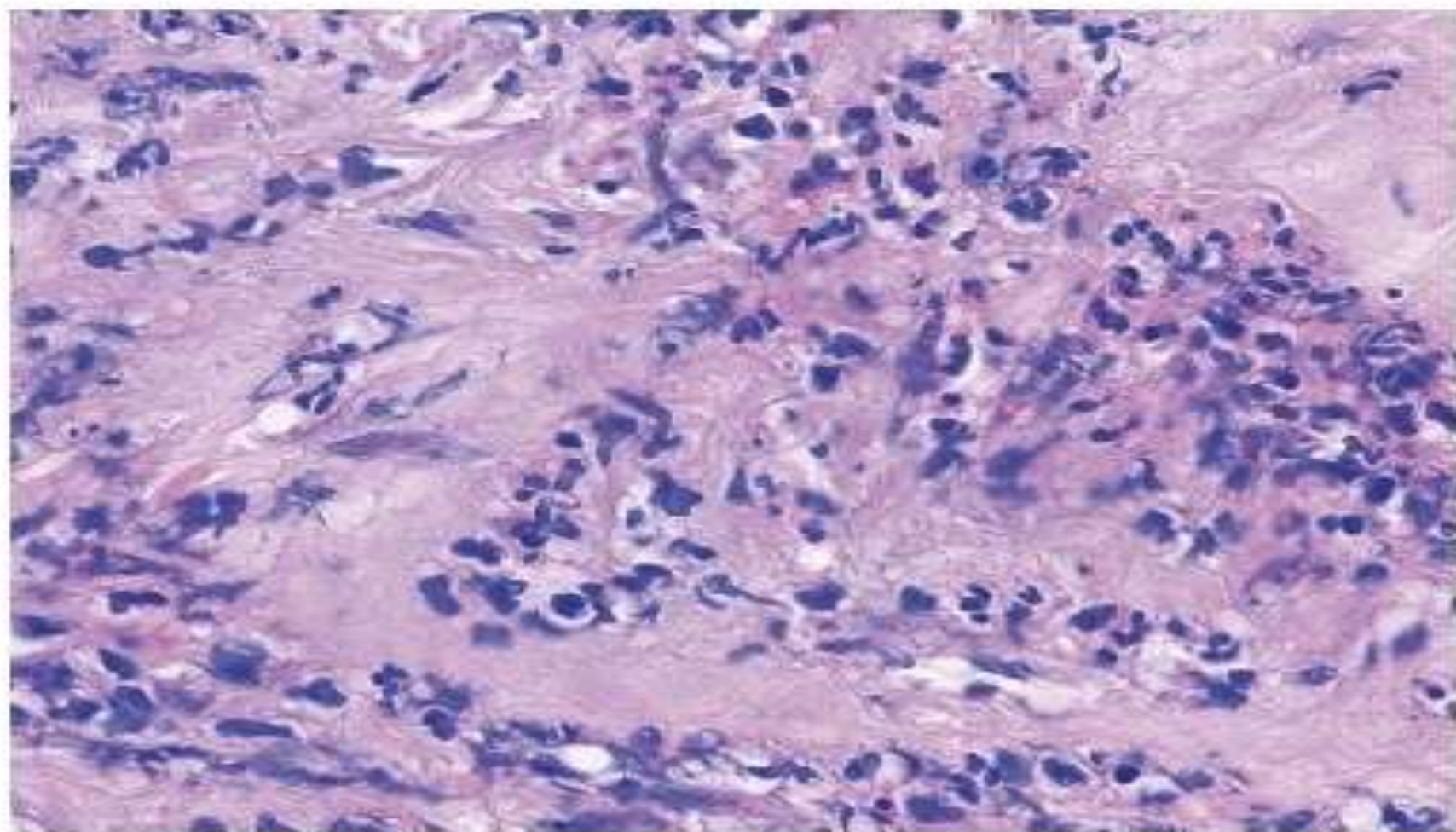




## Conclusion

In summary, our findings suggest that PD, as is currently practiced, may not be a suitable choice for ESRD patients with PAD and that that HD is a preferred therapy. Given the epidemic of atherosclerosis and alarmingly high prevalence of PAD in ESRD patients, there is an urgent need for a large size prospective study in this population. Further study is also needed to explore the accurate mechanism on the mortality discrepancy between PD and HD in this population.

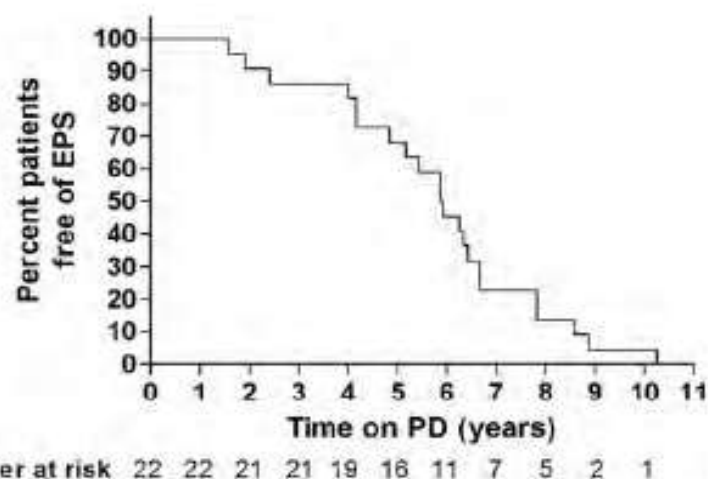




**Fig. 2.** Haematoxylin-eosine-stained peritoneum. Sclerosing connective tissue with chronic active inflammation (lymphocytes, activated fibroblasts and hyalinized collagen, macrophages) without granulomatosis.

**Table 1. Clinical presentation, radiological findings on ultrasound and CT scan in children with EPS**

	Number	%
<b>(A) Clinical signs and symptoms at EPS diagnosis</b>		
Bowel obstruction	20	91
Vomiting/abdominal distension/altered bowel habits	20	
Complete obstruction	3	
Bowel perforation	3	
Intra-abdominal mass	8	
Ascites	4	
Haemoperitoneum	2	
Malnutrition (>10% weight loss in 3 months)	16	73
Ultrafiltration failure	15/17 on PD	88
<b>(B) Radiological signs</b>		
Small bowel dilatation and abnormal peristalsis	21	95
Matted bowel loops with tethering to the posterior abdominal wall	8	36
Peritoneal thickening	14	64
Peritoneal calcification on CT scan	11	50
Loculated/septated ascites	7	32
Haemoperitoneum	2	9



**FIGURE 1:** Kaplan-Meier survival analysis showing the time to development of EPS.

# Conclusions

- ✓ The modality of RRT must be individualized.
- ✓ Encourage and support daily HD for ESRD patients.
- ✓ Incident ESRD with CHF / PAD (HD will be the ideal modality of RRT).
- ✓ PD will not be the proper life-long therapy for ESRD patients (BRIDGE).
- ✓ High index of suspicion is required for the diagnosis of EPS.
- ✓ EPS is a serious complication in PD patients that can persist even when the patient is shifted to other RRT modality.



# THANK YOU

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